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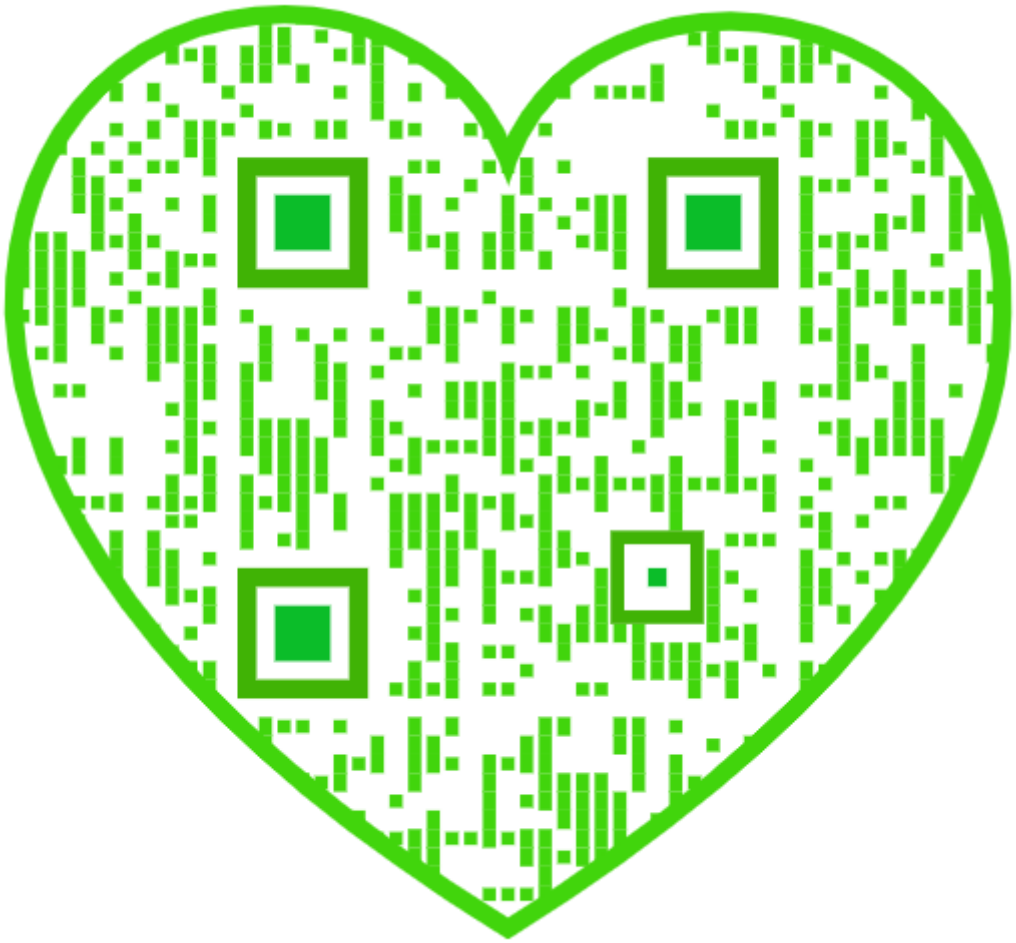

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GOVERNMENT DOCUMENTS

WINTERING BEES IN CANADA

Revised in 1922 by

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From Bulletin 43, by the late F. W. L. Sladen, Dominion Apiarist

DOMINION OF CANADA

DEPARTMENT OF AGRICULTURE

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THE EXPERIMENTAL FARMS BRANCH

E. S. ARCHIBALD, B.A., B.S.A.
DIRECTOR.

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WINTERING BEES IN CANADA

INTRODUCTION

THIS bulletin discusses a vital factor in the building up of the beekeeping industry in Canada—the preservation of the bees during the winter. There die in Canada every winter large numbers of colonies which a little care and forethought would have saved. Many more are seriously weakened, also for the want of timely and intelligent preparation. It is far better to exercise this care than to find empty and depleted hives in the spring, and make the bees that survive spend the best part of the summer filling them again. The remarkably high yields of honey in many places in Canada, and the good price that honey now brings, offer a strong financial inducement to prepare the bees for winter with the most intelligent care. To put off the preparation of the bees for the winter until cold weather has arrived is to court disaster, because exposing the bees to cold early in winter and disturbing them during cold weather are injurious.

The long and cold winter in many parts of Canada is not so hard on the bees as might be imagined, and in some respects wintering is easier than in a mild country like England, or in the Southern States. This is because the bees rest more completely during the winter in Canada. Few conditions are more trying to bees than those encountered in the British Isles during February, March and April, when they wear themselves out and die by hundreds in raising a little brood and flying out to visit the early flowers in the chilly, changeable weather. The same conditions occur on Vancouver island. In most parts of Canada, however, the winter rest continues until some time in April. Then come quickly the long warm days; the bees breed up fast, and the colony becomes strong in a remarkably short time.

We have, however, learned several things about wintering bees in Canada, the neglect of any one of which will bring ruin and death to the colony. One of the most important of these requirements is strong, that is to say, populous colonies, consisting mainly of young bees; another is an abundant supply of wholesome stores in the combs; and a third is adequate protection from the cold. The successful wintering of bees in Canada depends mainly upon these three points.

Bees do not hibernate in the true sense. When it grows cold, they form a compact cluster, and the bees in the heart of the cluster produce heat by muscular activity which is derived from the consumption of food. Those at the outside of the cluster act as insulators to prevent the escape of the heat, and are thereby warmed themselves. Phillips has shown that bees begin to cluster when the temperature in the hive falls to 57° F. The temperature of the air inside the hive during winter should therefore be below, but not far below, 57 degrees.

As a result of the consumption of food, waste matter collects in the intestine. Healthy bees discharge this waste matter only during flight, but in many parts of Canada the winter is too cold for bees to fly for four, five, or even six months. This long period makes it of the greatest importance that the bees be so well protected from the cold that they will not need to consume much food, also that the food be perfectly wholesome and as free as possible from indigestible matter. If the cluster is small, or the bees have been exposed to severe cold during the early part of the winter, and especially if the food is unwholesome, there will be a heavy consumption of stores and a rapid accumulation of fæces, bringing about a condition known as dysentery,

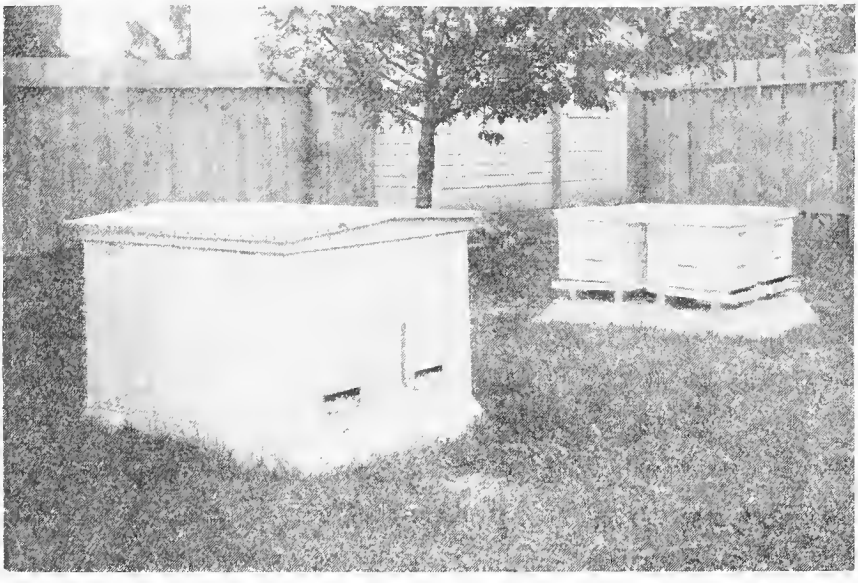


Illustration showing group of four colonies on permanent stand before packing, also quadruple case packed.

SNOW SCENE
Snow acts as a blanket and protects the bees from severe weather.

that shows itself in excessive heat production and in great restlessness, many of the sick bees leaving the hive as soon as the temperature rises a little, but while it is still too low for a favourable flight, so that they die outside in large numbers. Usually the abdomen is distended and the mouth of the hive is soiled with the brown fæces. In a bad case of dysentery, the colony usually dies before spring, or it survives with so few bees, and these so much enfeebled, that it fails to become profitable.

Since bees wear and age in winter just as surely, though not so rapidly, as in summer, and a maximum population is needed to survive far into the spring in order to raise a large quantity of brood then, it is important that the bees going into winter should be young.

These facts explain why successful wintering depends principally upon the above-mentioned three conditions, which we may repeat: populous colonies, consisting mainly of young bees, plenty of wholesome stores in the combs, and adequate protection from the cold.

STRONG COLONIES OF YOUNG BEES

By young bees we mean those that have done little or no field work, but they should have had at least one flight before winter. Where there is no late honey flow, these bees will be raised principally in August and early September. The best way to get bees raised in large numbers in August and September is to have in the hive a queen raised the same year, this queen to begin laying not later than the middle or end of July. This means that she should be raised in June or early July, during the honey flow from clover. No better conditions for rearing queens exist than those found in Canada during the clover honey flow. Not only will the colony containing this young queen raise more and better bees for winter than one containing an old queen, but the young queen will be more prolific and profitable the following season. It may not, however, be convenient to requeen every colony every year, and a vigorous year-old queen will make a good colony for wintering if the colony is strong in July. Colonies that are not strong in the fall should be put together so that each hive contains enough bees to crowd over at least eight combs of Langstroth size before the weather is cold enough for clustering closely.

WHOLESOME STORES IN PLENTY

It is fortunate that, as a rule, the honeys of the north are more wholesome for wintering than those of the south.

Clover honey is an excellent winter food for bees. In places around Lake St. John, Que., where the honey stored comes entirely from alsike and white clover, the bees winter well in spite of nearly seven months of confinement in the cellar. Buckwheat honey has also been found satisfactory for wintering in the region where this plant gives nectar.

On the other hand, dandelion honey has proved unwholesome. Some of the honeys gathered in late summer are also unwholesome, especially those found in certain marsh districts in the Maritime Provinces. The honey of the hard maple has been complained of by beekeepers in southern Ontario. Dandelion honey and the honey reported to come from hard maple granulate so hard in the combs that the wintering bees may find it difficult or impossible to remove and use the honey. At Ottawa, hard granulated honey, which it is suspected comes partly from sweet clover, occasionally causes considerable loss of bees in winter for the same reason.

In some places, especially in parts of the north, the bees are sometimes unable to ripen and seal the honey gathered from aster and other late sources owing to the rapid onset of cold weather. Such unripe honey is liable to ferment, and in this condition it will quickly cause dysentery.

Dysentery and death will also rapidly follow the consumption of winter stores consisting partly of fruit juices gathered by the bees, for instance, from over-ripe raspberries, or from plums that have been punctured by birds or insects, or from blueberries that have been burst by frost. Honey-dew, the excretion of plant lice dropped on the leaves of trees and collected by the bees, is also very injurious, because it contains a large proportion of indigestible matter. Fortunately, it is produced and collected by the bees less frequently and less extensively in Canada than to the south.

The best substitute for unwholesome stores is a pure sugar syrup made by stirring two parts by measure of granulated sugar into one of boiling water and allowing it to cool. This syrup should be given about the middle of September, or in southern Ontario early in October. This will give the bees time to cap over most of the syrup while the weather remains warm, and to consume enough to form an area of empty cells in the lower part of the middle combs for the winter cluster to occupy before cold weather. This syrup should be given in feeders placed in the hives. A 10-pound honey pail with a number of small holes punched in the lid and placed upside down over the combs makes a good feeder.

In most places the stores left in the hive after the supers have been removed in the fall are from mixed sources, and only fair in quality. They are also usually deficient in quantity. A good and widespread practice is to feed each colony with syrup enough to bring it to a sufficient weight, giving in no case less than about 15 pounds. The syrup being stored close to the cluster is consumed before the honey, and thus the accumulation of fæces is delayed.

The quantity of stores to be left or provided for the winter should be estimated liberally. The quantity that a colony consumes varies considerably, and when the stores are inferior, may be more than twice as much as when they are good. Heavy consumption of stores also results from several other causes. Bees wintering outside consume more stores than in the cellar. The most common cause of the death of colonies in winter is starvation by the exhaustion of their stores. As a general statement, it may be said that at least 40 pounds of stores should be left with each colony in order to last it from the time of feeding in September until new honey is collected in the spring. Although the winter consumption may not reach 20 pounds per colony in some colonies, much or all of the surplus will be needed for feeding in the spring.

Since the ordinary factory-made single-walled 10-frame Langstroth hive of eastern white pine, with the combs, pollen, and bees, but without the cover, usually weighs, if dry, between 30 and 40 pounds, such a hive when ready for winter should weigh between 70 and 80 pounds. In addition to the stores left in the hive, the bee-keeper will be well advised to set aside combs of honey to be given to the colonies in spring.

PROTECTION FROM COLD

There are two ways of protecting bees during winter—out of doors in cases filled with packing material, and indoors in the cellar. Generally speaking, the packing case is preferable in southern Ontario, the Annapolis Valley, N.S., and British Columbia, in all of which places the winter is comparatively mild, and the cellar is more satisfactory in the north and on the prairies. But in many places, that is to

say, in the wide belt where both methods produce about equally good results, a more important factor in deciding which plan to adopt is convenience. If the beekeeper has a deep and dry cellar and well insulated from changes in temperature, by using it he can save himself the cost of making cases and the labour of packing the bees. If, on the other hand, the apiary—perhaps an out-apiary some distance from the beekeeper's residence—is well sheltered from wind, and no suitable cellar is available, cases may be used and the bees, snugly packed away in them, will need no attention throughout the winter, nor indeed until spring is well advanced, by which time they will be found to be in a more forward condition than those that have been brought out of the cellar and have been placed on their summer stands without protection.

WINTERING OUTSIDE

In wintering bees outside, it is very necessary to protect the apiary from wind, and if there is not a good windbreak on all sides, consisting say of evergreens, which are much more satisfactory than buildings, a fairly close board fence about eight feet high should be erected around the apiary.

The best and most economical type of wintering case for the bees is one made to take four hives en bloc and usually back to back. It uses less material per colony than cases made to take only one or two hives, and each colony is protected on two sides by its neighbours. The credit for inventing the four-colony case is by general consent accorded to Jacob Alpaugh, a Canadian.

CONSTRUCTION OF QUADRUPLE CASE

The four-colony wintering case shown consists of seven pieces: stand, floor, two sides, two ends and cover. It is made to hold either four Langstroth or four Jumbo hives with three inches of packing underneath and about their sides and 8 inches to 10 inches of packing on top surmounted by a few inches of air space.

The stand is made of $\frac{7}{8}$-inch material with blocks in the corners and a central stringer on which the floor cleats bear.

The floor is also made of $\frac{7}{8}$-inch material; it bears indirectly through the cleats on the corner blocks and stringer, and directly for $\frac{1}{4}$ inch on each side of the stand.

The sides are constructed of $\frac{5}{8}$-inch material and bear indirectly on the stand—the outsides being flush with the outsides of the stand.

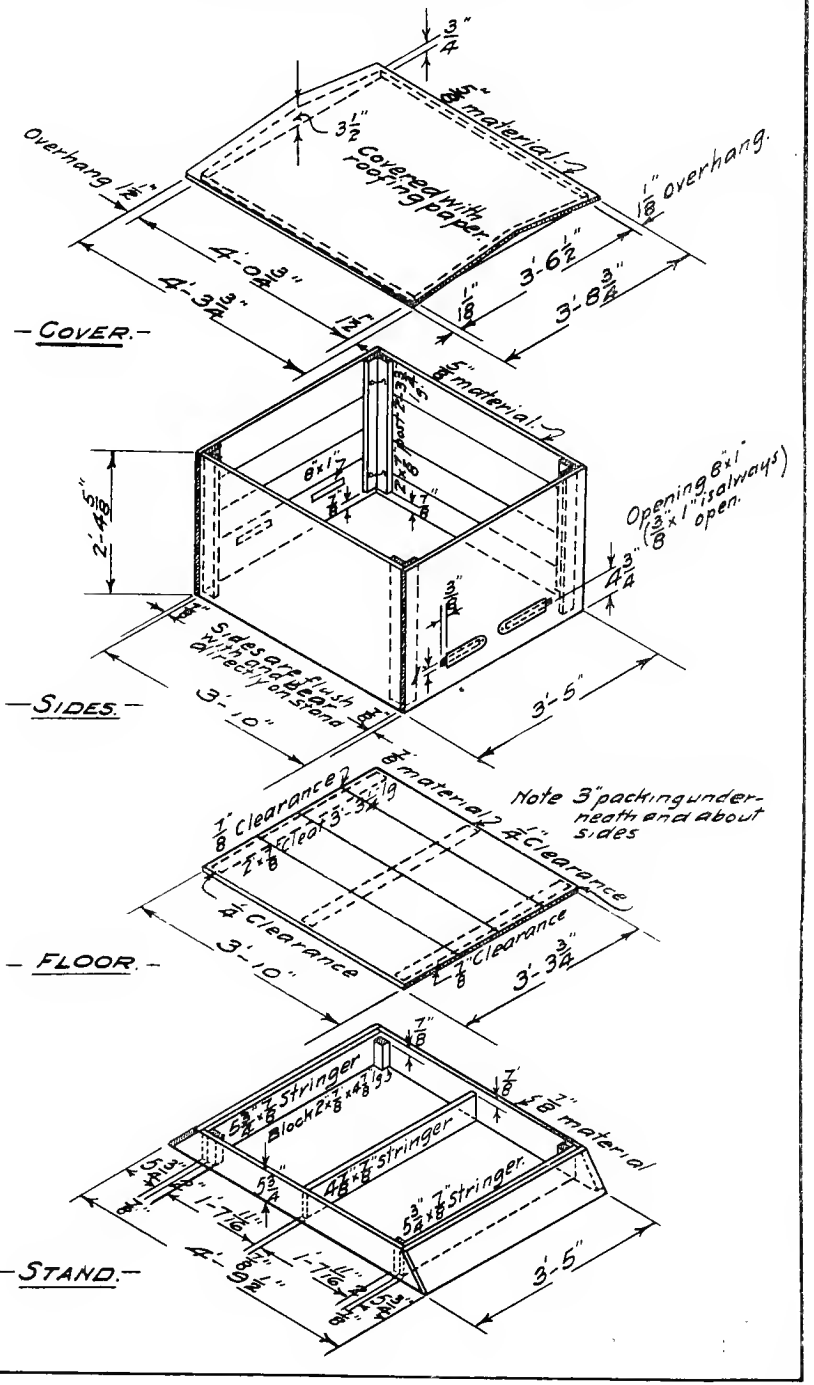
The sides and ends are fastened together by hooks attached to the corner posts. In each end 8-inch by 1-inch entrances are made with revolving covers to reduce them to 1 inch by $\frac{3}{8}$ inch for the winter.

The cover is constructed of $\frac{5}{8}$-inch material and made to telescope over the sides —roofing paper being used or other suitable material to shed the rain.

The case should be at least large enough to allow for three inches of packing between the hives and the sides and bottom of the case, and eight or ten inches surmounted with an air space on top of the hives. Where the regular single-walled ten-frame Langstroth hives are used, these spaces will require a case having inside dimensions of 46 inches by 39$\frac{3}{4}$ inches, and about 28 inches high. The sides and floor of the case should be of grooved and tongued boards. The roof should be of thin boards nailed to a strong frame that telescopes over the sides, and it should be covered with roofing to make it waterproof.

B

—QUADRUPLE CASE.—



It is convenient to make the case collapsible. The sides may be held together by hooks, or they may be held together more firmly by means of a thumb-screw placed near the top and operated from the inside in combination with dowels in the floor to prevent spreading below, the thumb screws and dowels to be held in cleats fixed on the sides.

The construction of the flight holes in the case needs particular attention. They should be cut in the sides of the case opposite the entrances of the hives, but at least a foot apart. In winter, the flight holes should be of the smallest size that permits the passage of bees without danger of blocking, but in spring, a considerably larger size is necessary. A satisfactory way to meet these conditions is to cut the hole four to eight inches wide by one inch high and to have a close-fitting piece of wood revolving on a screw which will reduce it to one inch by three-eighths of an inch, or three-eighths by three-eighths of an inch. There should be no projecting ledge beneath the winter entrance to lodge snow and ice.

The packing material should be of small size, supplying numerous dead air spaces, such as planer shavings or dried leaves that have been kept for at least a year. The material on top may be placed in a large sheet or a large bag for easy removal and replacement to permit of the occasional examination of the colonies in spring.

Canadian conditions require cases of somewhat different construction to those that are used in many parts of the United States. In our experiments at Ottawa, it has been found that the entrance is too small in spring if it consists of holes only three-eighths of an inch in diameter. It has been found that the aspect of the entrance makes little or no difference to results. It may face north, south, east or west. No drifting of bees from one hive to another to matter has taken place provided flight holes have been a reasonable distance apart, say 18 inches. Indeed, a smaller distance has been found satisfactory if a stake is driven into the ground between the two entrances. So far, extra thick packing has not been found particularly advantageous.

The bees should be packed in the winter cases in September, preferably before the fall feeding is done. To avoid loss of bees, the hives, if standing in rows, should be gradually brought together during the late summer so as to occupy nearly the same position and face the same way as they will in the case. A less satisfactory plan, advisable only when the honey flow ends early, is to delay moving the hives and packing them in the cases until the bees have been confined to the hives by chilly weather for two or three weeks. In placing the hives in the case, the covers should be removed in order to bring the hives close together, but in a cold region, it is advisable to leave over the combs a board or oilcloth quilt to prevent the escape of too much heat and moisture. Passages for the bees over the combs may be provided by placing sticks under the quilt. In order to prevent the passage between the hive entrance and flight holes in the case becoming choked with dead bees in winter it should be at least five-eighths inch deep.

It is not necessary to remove the snow surrounding the cases during the winter, because the bees are not likely to smother even if buried deeply in it. In some places, however, it is an advantage to remove the snow towards the end of March.

The bees should not be removed from the cases until spring is well advanced. The extra good protection afforded in spring by the packing, especially during the first few weeks of breeding, is one of the main advantages of outside wintering. It is a good practice to leave the hives in the case until the cases become inconvenient for tiering supers (there is usually room for the first super). This may not be until June.

Experiments covering seven years at Ottawa have shown that colonies wintered outside in the four-colony cases begin breeding earlier and average stronger by the end of May than those wintered in the cellar, but that they are more liable to die in the winter, especially if it is a hard winter and if they have not been prepared in the best manner. On the whole the advantage is in favour of wintering outside.

These remarks are based on the use of the Langstroth hive, which has combs in frames 9¼ inches deep and a space of five-eighths of an inch between the bottom bar of the frames and the floor of the hive. In wintering outside there is some advantage in having the combs somewhat deeper in order to give each section of the cluster a larger available food supply, and in having more space under the combs, especially towards the entrance. These features can be provided in the regular Langstroth hive by placing over the brood chamber a shallow super containing combs of honey, and by slipping a thin wedge between the brood chamber and floor on each side. The additional stores and room supplied in the second chamber are particularly useful for stimulating breeding in spring. It must be remembered, however, that in a cold region it is not so easy for the bees to keep warm in a large hive as in a small one.

WINTERING IN THE CELLAR

In a good bee cellar the temperature keeps steady between 45° and 50° F., the air is fairly dry and well ventilated, and light is excluded. Two of these conditions, the steady temperature and moderate dryness, are not always easy to obtain and maintain. To secure them, two important principles in cellar construction should be observed: the cellar should be so low in the ground that it is very little affected by changes in the outside temperature, and the ground should be well drained.

In a cold region, however, excellent results may usually be obtained, especially if only a few colonies are to be wintered, by boarding off for the bees a portion of the basement of the beekeeper's residence, not near to, nor very far from, the furnace, because the furnace and the warmed rooms above help to supply and maintain the required conditions so well that minor defects in the construction of the cellar do not matter, and but very little special attention is needed because the temperature is maintained and regulated by the furnace which burns better in the colder weather. The warm air around the furnace rises and causes air circulation, which dries and ventilates. If, in mild weather towards spring, the temperature is apt to rise too high, the cellar may be cooled by opening the basement windows a little. The chamber for the bees should be near or against the wall of the basement. This part of the wall may be banked outside with earth to above the level of the bees' chamber. The bees should not be placed in the same room as the roots.

Where a cellar is specially excavated for the bees, concrete is a good material for the walls, and it is a good plan to build over the cellar the house that is to be used as a workroom, for extracting the honey and for storing bee supplies. If the rooms above the cellar are not heated during the winter, it will be necessary to have the ceiling of the cellar double-walled with a large interspace packed with sawdust or other non-conducting material. The height from floor to ceiling of the bee cellar should be about six and a half feet, and the ceiling should be below the frost line. For good drainage and insulation, the side of a hill is a desirable place for building a bee cellar, and such a location has the advantage that a door can be placed at the floor level for easily bringing the bees in and out. To prevent the escape of heat, there should be one or two inner doors. To carry off the moisture produced by the bees, and to supply ventilation, a chimney should be provided. This chimney may open into the upper chamber.

For every volume of honey consumed, the bees give off an amount of moisture that, if condensed, would make an approximately equal volume of water. If the air of the cellar is already laden with moisture, the moisture produced by the bees will condense in the hive, a condition that if it occurs to any great extent and is long continued is liable to do great injury to the bees.

Very dry conditions are also unfavourable, especially towards the end of a long winter when more or less dysentery has developed. The stores may lose so much water that the bees are unable to remove them from the cells and the colony may die in consequence. This condition occurs most frequently in connection with granulated stores, but it sometimes takes place with stores that do not granulate, such as buckwheat honey and sugar syrup. Soft candy given to a colony suffering from this trouble will harden, and thus it, too, becomes unavailable for food, and the colony may starve.

In Canada, ventilated cellars are liable to become very dry in cold weather because of the small amount of water contained in the outside air that is drawn in. Air at zero can hold only one-sixth of the weight of water that air at 45° can hold. The increase in moisture that occurs in a very dry cellar towards spring, as the outside temperature rises, is beneficial to the bees. In a dry cellar, an earth floor may be better than a cement floor.

Some cellars are fitted with an air intake from outside entering the cellar at or near the floor in addition to the chimney outlet. There is no question that by this means excellent ventilation may be obtained, and the cellar may be made dry, but these things are secured at the expense of making the temperature of the cellar too cold and changeable. The trouble with such a system of ventilation is that, contrary to the furnace, which regulates itself automatically, it acts least when most wanted and most when least required. In cold weather when warm, moist air is needed, cold dry air is drawn in strongly through the smallest opening, while in mild weather when cool, dry air is desirable, very little air will enter through the largest opening, and this is comparatively warm and moist. Therefore the ventilators need to be kept almost closed in cold weather, and opened wide in mild weather, and thus they need frequent adjusting in regions where mild weather alternates with cold during the winter. But in a region where it stays cold through the winter, the ventilators do not need much attention. Indeed, such a region provides us with two ways in which the draught may be, in a rough measure, automatically reduced in winter and increased in spring. These are the reduction or even closing of the mouth of the cellar chimney by hoar frost from the condensed moisture from the cellar in the winter, and the heating of the chimney or of the building containing it (provided this has a chimney) by the warm sunshine in spring, because by the time the cold weather ceases, the sun is high and powerful.

The necessity for frequently adjusting the ventilators in a region where cold alternates with mild weather, especially in cellars not deep in the ground, constitutes a serious disadvantage to wintering in such cellars in southern Ontario and in southern Alberta. In southern Ontario, cellar wintering has therefore been largely replaced by outside wintering, and in southern Alberta, where the temperature changes are very great and sudden, and the ground is dry, good results have been obtained at the Experimental Farm at Lethbridge by wintering in a dug-out.

For convenience, we have spoken of the temperature and humidity of the bee cellar. The temperature and humidity, however, that we need to consider are those of the air in the hive surrounding the bee cluster. This air may be warmed and moistened to some extent by reducing the size of the entrance of the hive, and by placing a warm impervious cover over the hive.

In taking temperatures, it is very necessary to have a reliable thermometer. Cheap thermometers may be quite accurate at 32°, but may be several degrees in error between 45° and 50°, which are the principal temperatures that we wish to record accurately in the bee cellar. The temperature near the ceiling of the cellar is usually several degrees higher than near the floor.

If it is desired to measure the relative humidity of the bee cellar, a dry and wet bulb thermometer may be waved or revolved briskly in the air and the percentage of relative humidity may be calculated from tables based on the differences in the two readings. About 50 per cent relative humidity in the bee cellar is a good percentage, but a wide range from below 40 to over 60 per cent may also be satisfactory. Under certain conditions, and for a short period, as low as 30 per cent and as high as 80 per cent may do no harm. It must be remembered, however, that while the relative humidity of the main part of the cellar may be low, and it may also be comparatively low inside the hives in the upper tier, the relative humidity in the back corners of a hive in the bottom tier in a damp, cool corner of the cellar may be at saturation and water may stand here the whole winter and mould the combs and do considerable harm to the colony.

It is the usual practice of Canadian beekeepers to keep the bee cellar temperature rather low, at about 42°, because it is found that a higher temperature frequently makes the bees restless, especially towards spring. This restlessness, however, as has been shown, does not originate from the high temperature but from unfavourable conditions, of which the most important is unwholesome stores which make the bees restless in the higher temperature. It is quite possible, by having the bees on wholesome stores and bringing them into a suitable cellar before they have been exposed to much cold, to keep them quiet in a cellar temperature ranging from 47° to 52° throughout a long winter, and under such conditions they winter very well.

The entrances of the hives in the bee cellar should be left open—wide open in most cellars—and the bees should be disturbed as little as possible. Mice must be kept out of the bee cellar; they will do great harm to the bees and combs if allowed. The air of the cellar should be kept clean and sweet, and for this purpose in a cellar crowded with hives, the dead bees should be swept up and removed once or twice during the winter.

Beginners are often in doubt as to the best time to bring the bees into the cellar and when to take them out. The best time to take them in is as soon as possible after they had the last good flight that can be expected. In many places, this is early in November. The best date to bring them out is usually when the willows come into bloom; that is to say, when the blossom heads are showing yellow, if the weather is favourable. But on the coast and in other places where a considerable period of chilly weather may still be expected it will be wise to leave them in the cellar a week or two longer. If, however, the bees are very restless and the mouths of the hives are much spotted with dysentery, it may be advisable to bring them out before willow bloom in the early morning of a day that promises to be sunny and warm in order that they may get a good cleansing flight as early as possible. The best time of day to bring the bees out of the cellar is in the evening or early morning, because an immediate flight is not desirable, and may cause confusion and robbing. Laundered articles should not hang out to dry near the apiary after the bees have been brought from the cellar until they have made their cleansing flight.

SPRING MANAGEMENT

In many places it is an advantage to protect the colonies that have been brought out of the cellar with packing cases or paper covers, but at Ottawa, where the spring

warms up quickly in average seasons, this has not been found to be worth while; however, packed covers are desirable. It is important that the hives should be put in a place sheltered from cold winds, and the size of the entrance should be reduced.

The colonies may be examined on a warm day when the bees are flying freely. Those having less than ten or fifteen pounds of stores should be given combs of stores to make up the deficiency, and colonies that are without queens or that have drone breeding queens, should be united to weak colonies that contain fertile queens. Very weak colonies may be saved by placing them over strong colonies with a queen excluder between.

It is wise to defer this first examination until after a few days of favourable conditions and nectar is coming in freely. In their first flight after the winter, the bees of the different colonies mix considerably, especially if wind blows through the apiary, and the large numbers of strange bees in the hive with no nectar coming in are liable to cause the queens to be attacked, balled, and possibly stung, so that one or two of their legs may be paralyzed or they may even be killed, if the colony is opened and examined. Also at a later period the presence of a fertile queen can be more easily and quickly ascertained by noting the presence of capped worker brood, which can be distinguished from drone brood by its flat and not strongly convex cappings. Some queens do not begin to lay until some days after the colonies have been removed from the cellar. Further, there is a greater risk of brood getting chilled during early examination than when the weather is warmer.